Processes of managing collaborative model watersheds in Africa RISING sites

Landscape/watershed visit organized for Africa RISING team members of the west Africa, southern and east Africa projects

20-24 April 2015

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Contents for the presentation/discussion

1. Introduction
2. Why watershed management approach?
3. What interested AR project to work with local and CG partners in watersheds?
4. Which are the sites for the joint watershed management initiative?
5. Who are the partners currently participating in the watershed management initiatives?
6. What we have done so far and where are we now on the implementation of the R4D initiatives?
7. What are our next plans?

1. Introduction

- Population pressure, food-feed-wood shortages, deforestation, climate change, soil erosion, soil fertility depletion, water scarcity and degradation, and low crop and livestock productivity.
- Current and future scenarios of NRM related issues:

✓ Nutrient depletion

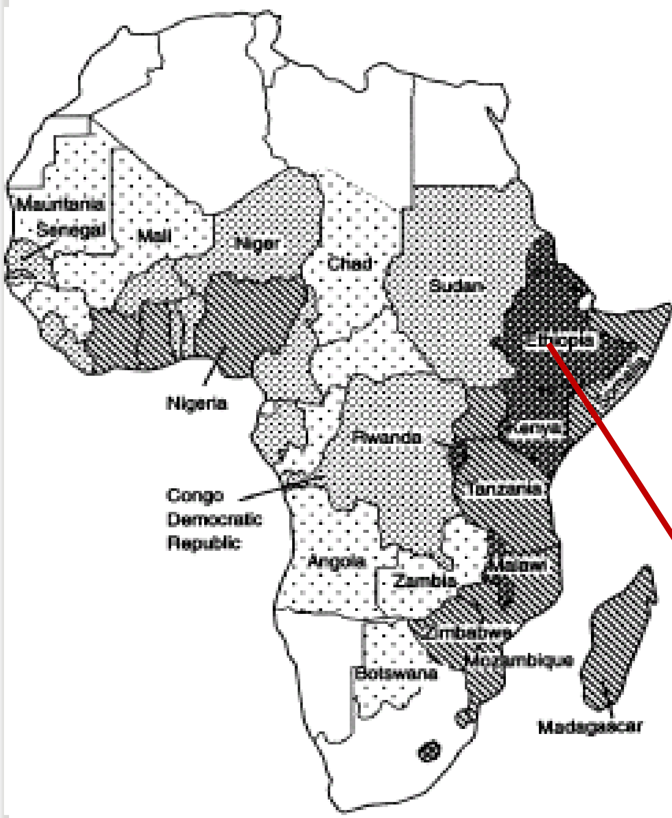
✓ Wood demand

✓ Feed-Food

✓ Crop yield – Examples

Soil fertility depletion

- Ethiopia is among the sub-Saharan Africa countries with the highest rates of soil
  nutrient depletion.



	Nutrient depletion (kg ha^{-1} yr^{-1})		
	N	P	K
Low	< 10	< 1.7	< 8.3
Moderate	10 to 20	1.7 to 3.5	8.3 to 16.6
High	20 to 40	3.5 to 6.6	16.6 to 33.2
Very high	⩾ 40	⩾ 6.6	⩾ 33.2

Soil erosion

- The annual soil erosion rate estimated to be more than 1.5 billion ton (Hurni, 1986)
- Estimated soil loss on crop lands: 42 t ha^{-1} yr^{-1}
- Soil loss and runoff assessment in the highlands of central Ethiopia (Zenebe et al, 2008):

Fallow land = 30 t ha^{-1} yr^{-1}
Cultivated land with soil bund = 23 t ha^{-1} yr^{-1}
Cultivated land without soil bund = 40 t ha^{-1} yr^{-1}

Feed shortage

- In balance between livestock population and feed availability
- Estimated available feed resources = 60.5 million t DM yr^{-1} (Adugna, 2007)

- TLU= 46.15 million
- Tropical Livestock Unit (TLU) = 250 kg livestock body weight
- Minimum feed requirement for 1 TLU = 2.3 t DM yr^{-1}
- Feed requirement for 46.15 million TLU = 106.14 million t DM yr^{-1}
- Average deficit = 45.64 million t DM yr^{-1}

(Calculated from CSA, 2009 livestock information)

Wood shortage

Wood demand and supply projections (M^3)

Year	Projected demand (000)	Projected supply (000)	Deficit (000)
2004	66,250	10,593	55,657
2008	74,967	9,895	65,072
2011	81,812	9,378	72,434
2014	88,899	8,844	80,055
2020	100,000	7,744	92,256

Source: EFAP (1994)

Poor crop yield

- Increasing food demand (African meet 13% of the continent's food needs by 2050)
- Stagnant yields for some crops (< 1 ton ha^{-1})

Poor barley crop performance in central Ethiopia

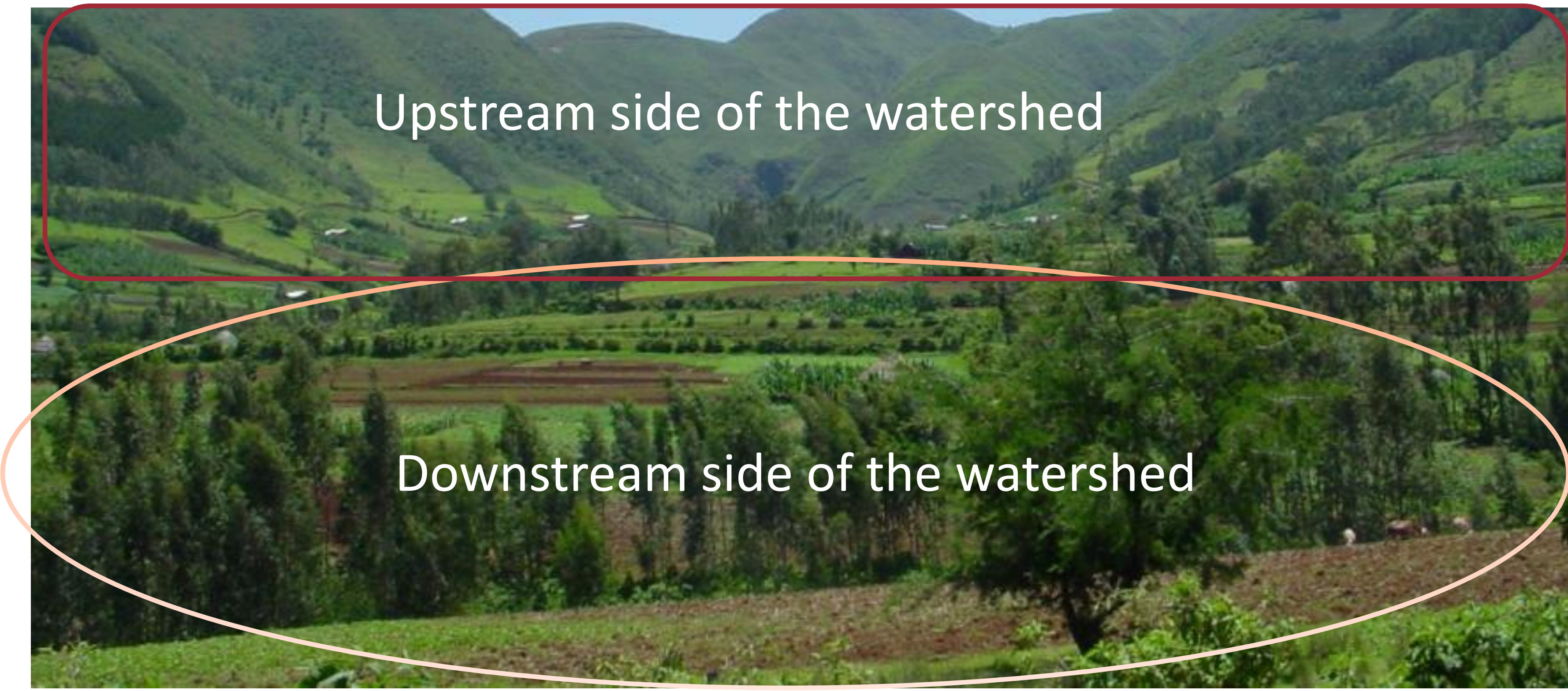
Sustainable intensification at farm/landscape/watershed level should be a pathway to fight resources degradation and poverty.

2. Why watershed management approach?

- Gives more attention to issues that need collective action such as soil and water conservation.

- Treats trans-boundary interactions between neighboring farms and villages for common properties such as forests, water, and grazing land.

- Gives much emphasis to issues that are beyond a farm level (e.g. individual owned and communally used lands such as farmlands after crop harvest).
- Helps to manage conflicts that can arise due to mismanagement of NR or Injustice on the use of resource (upstream vs downstream settlers).



- Encompasses various interrelated NRM components, and address multiple issues and objectives and enables us to plan within a very complex environment.

Biomass management

Land management

Water management

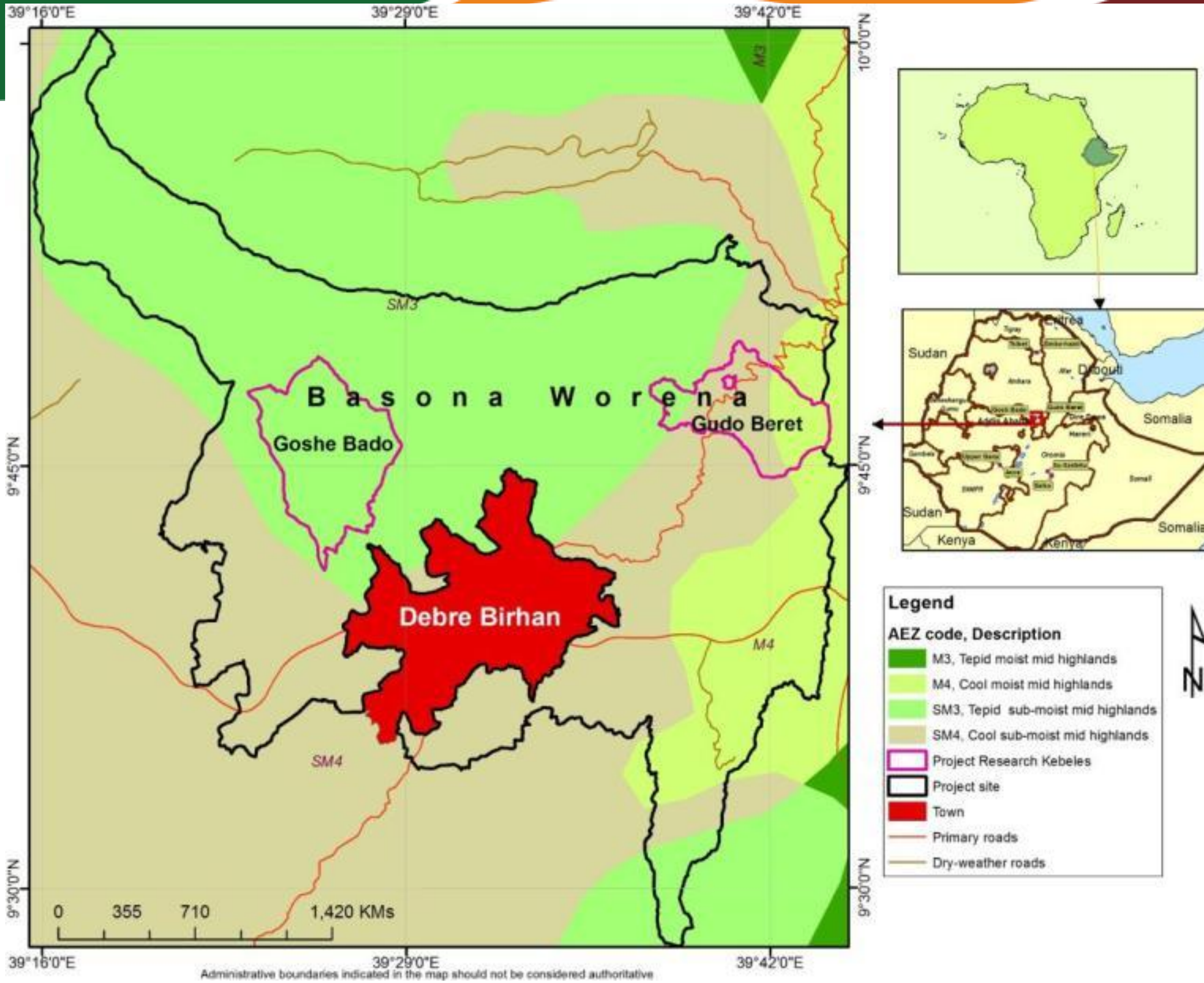
Livestock management

Management of social issues

3. What interested AR project to work with local and CG partners in watersheds?

- Request from the extension to get capacity building (technical and training) and technology demo support
- AR sees working in watersheds as an opportunity of scaling of its farm level tested technologies, management practices and approaches
- AR has discovered a number of researchable issues that might bring quick solutions and attract farmers to realize immediate benefits, e.g.:
- AR sees community mobilization and local administration commitment and investment on SWC as an opportunity for cost sharing and sustainability

4. Which are the sites for the joint watershed management initiative?




37°44'0"E
37°52'0"E
7°40'0"N
7°30'0"N
SH4
SH3
Upper Gana
Hossana
Jawe
L e m o
0 315 630 1,260 KMs
Sudan
Eritrea
Djibouti
Somalia
Kenya
N
Legend
AEZ code, Description
SH3, Tepid sub-humid mid highlands
SH4, Cool sub-humid mid highlands
Project Research Kebeles
Project site
Town
Primary roads
Dry-weather roads
Administrative boundaries indicated in the map should not be considered authoritative

5. Who are the partners currently participating in the w[illegible] management initiatives?

- CGIAR centers: CIAT, ILRI, ICRAF, ICRISAT, IWMI
- Local Universities: DBU, MU, WU
- Research Centers: DBARC, Areka ARC, Worabe ARC
- Extension: Basona Worena woreda office of agri,, Lemo woreda office of agri.
- Farmers both in Basona and Lemo

6. What we have done so far and where are we now on the implementation of the R4D initiatives?

- PRA activities
- Training
- Visits
- Mapping potential water harvesting niches
- Soil and nutrient loss assessment

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6. **What we have done so far and where are we now on the implementation of the R4D initiatives?**
7. **What are our next plans?**

6. What we have done so far and where are we now on the implementation of the R4D initiatives?

Target – “Create Climate-Smart Africa RISING Landscapes”

Team members and partnership

Process understanding

Co-implement interventions

‘Monitoring’ strategy

Protocol team members and partnership process

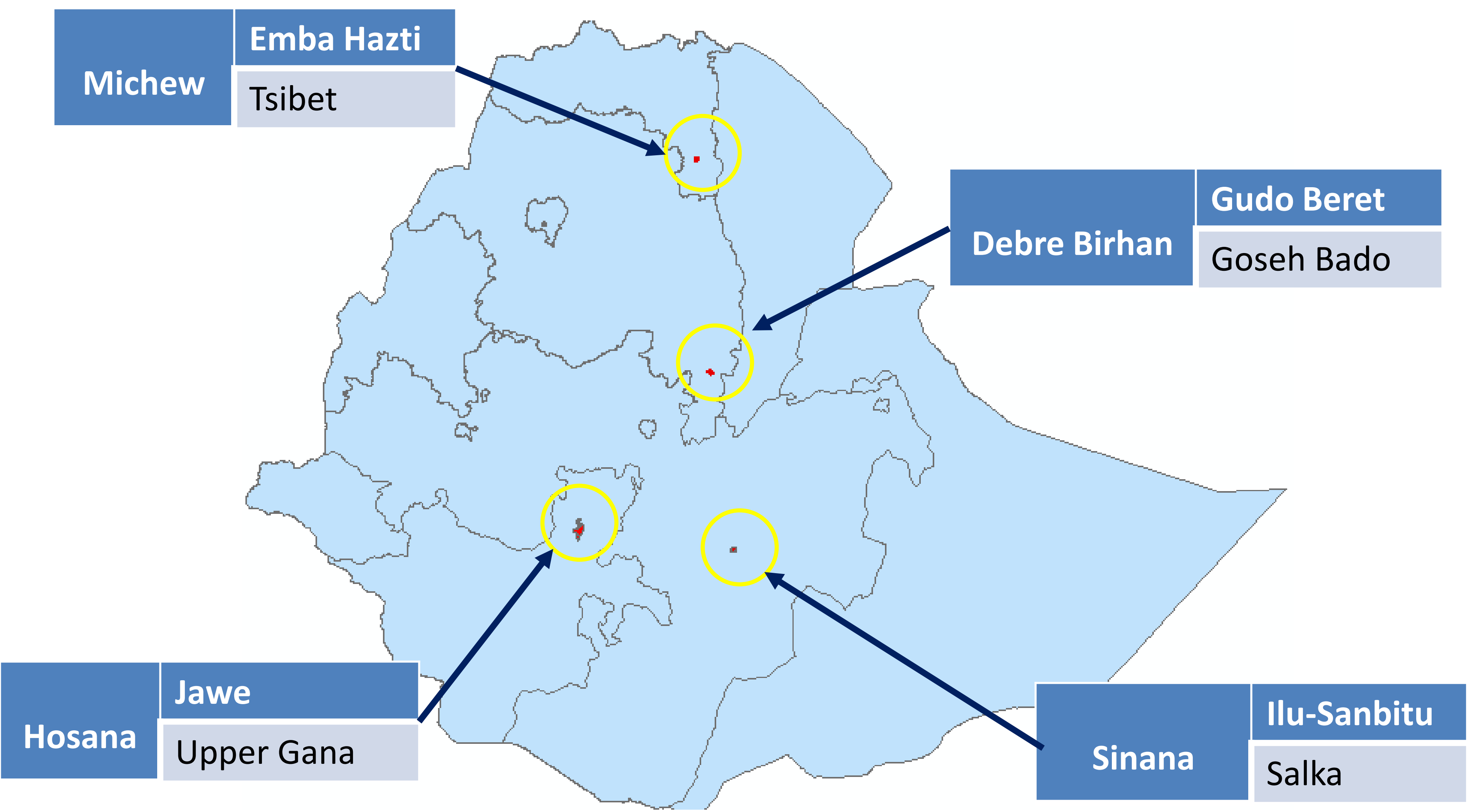
- CIAT, ICRAF, [ICRISAT], ILRI, IWMI, Mekelle University
- Co-developed protocol
- Discussed and agreed with Office of Agriculture to implement SLM activities at AR landscapes
- AR to provide capacity development including technical training as well as baseline and monitoring
- What intervention where and how to be co-managed by partners including local farmers

The IWM implementation process

Phases/steps:

- Field visit and preliminary discussion with partners and local community
- Participatory resources, constraints, degradation hotspot as well as interventions
- Transect walk with key informants(baseline and ground truthing)
- Training and exchange visit
- Identify options and implementation
- Monitoring and impact assessment

Field visit and preliminary discussion with partners and local community



Field visit and discussion with partners and local farmers

- Team members visited AR sites to get an overall feeling of landscape condition, challenges, opportunities and discuss with partners, Kebele admin and local farmers

Focus group discussion and PRA

FGD - 16 men and 6 women

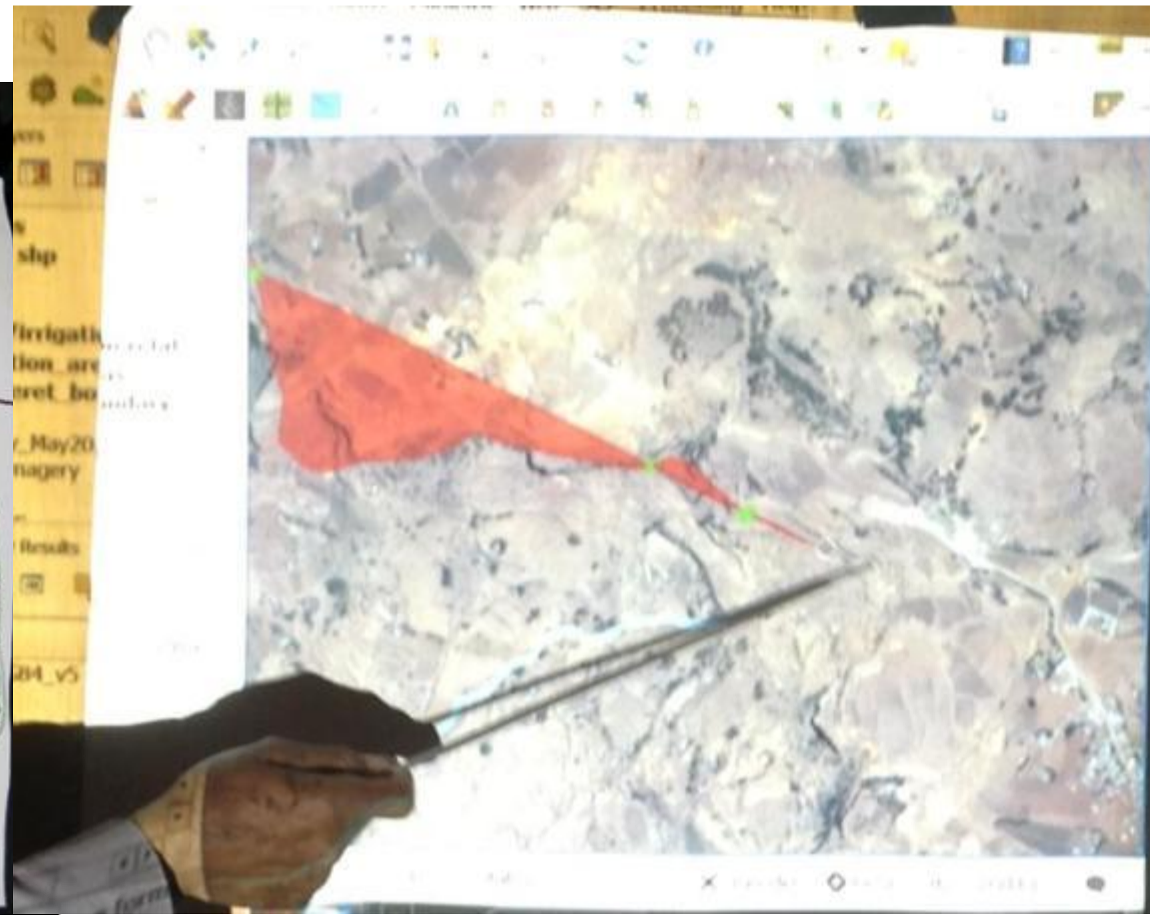
Farmers identified crop disease, water scarcity and land slide as major problems

Constraint	Remark
Faba bean and field pea disease	(Since 3-4 years)
Seasonal water scarcity	(Increased over time)
Land slide	(Severity aggravated)
Wheat rust	(3-4 years time)
Gully erosion	(Severity aggravated but prevailed for long)
Irrigation canal seepage	
Seed quality	
Technology related	(Debated by the chairman)

Hosana site – water, livestock and feed, poor soil fertility, soil erosion

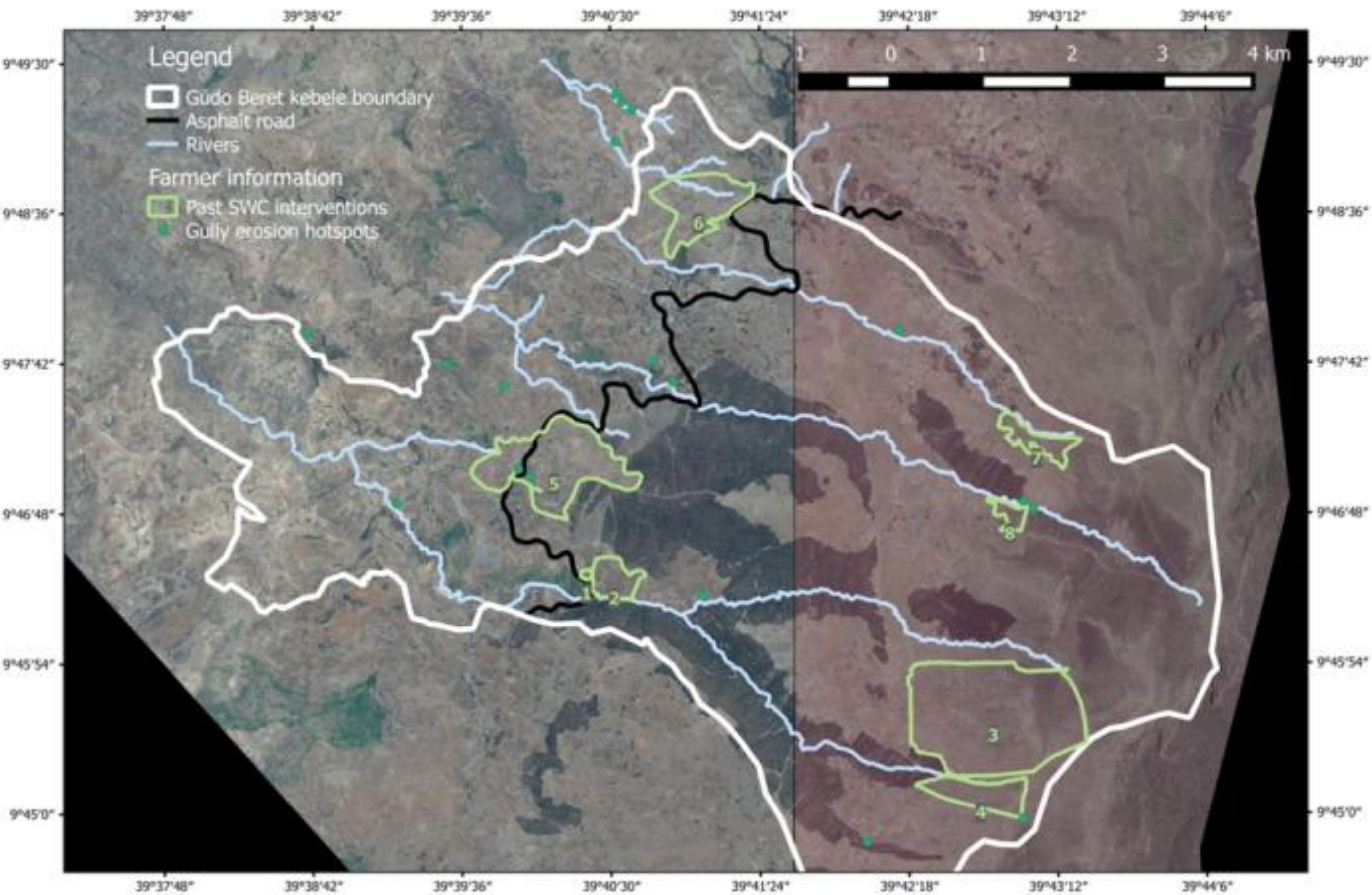
Participatory resource and constraint mapping:

Participants: Kebele Chairs, lead farmers, elderly men and women



Participatory mapping …

About 400 ha of land conserved since 2010.
Terracing - major intervention

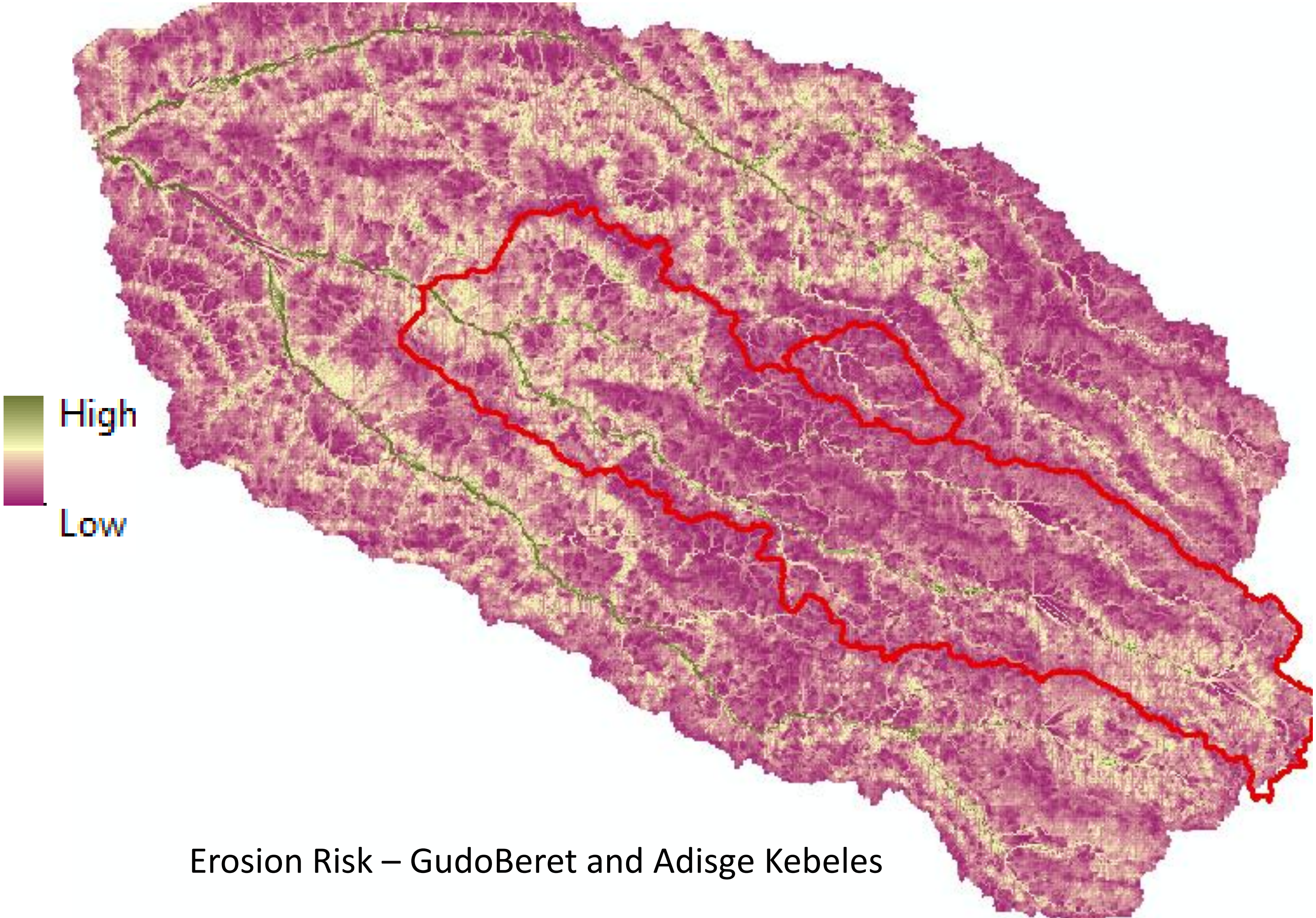


ID	Area (ha)	Year(s)	Intervention type
1	1.1	1999	terrace with grass
2	19.4	2010	terrace no grass
3	207.2	2010-13	terrace no grass
4	31.4	2011-13	terrace with grass
5	102.4	2010-13	terrace with grass + lucerne
6	53.5	2011-13	terrace with grass + lucerne
7	18.1	2010-11	terrace with grass ("guasa")
8	7.7	2011	terrace no grass

Transect walk with key informants

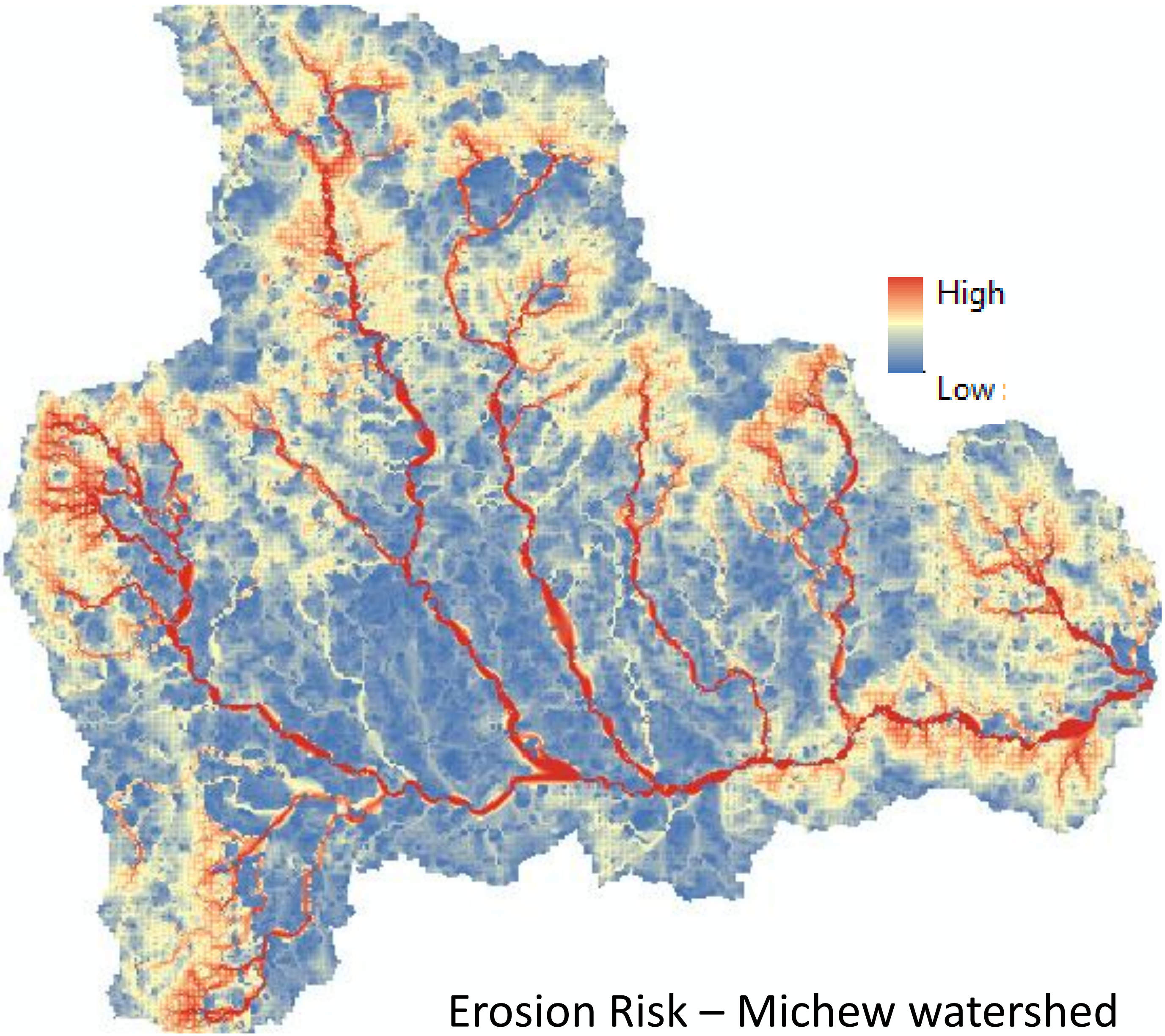
- Document features - baseline
- Ground-truth participatory mapping results
- Identify and measure gullies

Erosion/degradation risk mapping



Erosion Risk – GudoBeret and Adisge Kebeles

Erosion risk ...



Erosion Risk – Michew watershed

Training and exchange visit (off- and on-site): capacity development

Training on integrated watershed management: principles, experiences, opportunities

- *20 Participants from Gudo Beret Kebelle*
- *25 participants from Lemo Kebele*

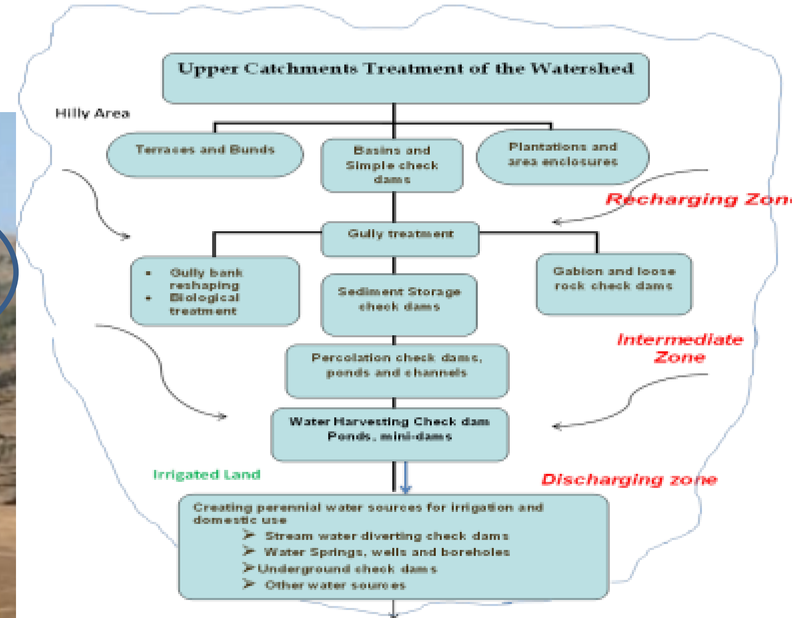
Experience sharing on IWM practices and achievements in Tigray: challenges and success stories

- *17 Participants from Gudo Beret Kebele*
- *16 participants from Lemo Kebele*

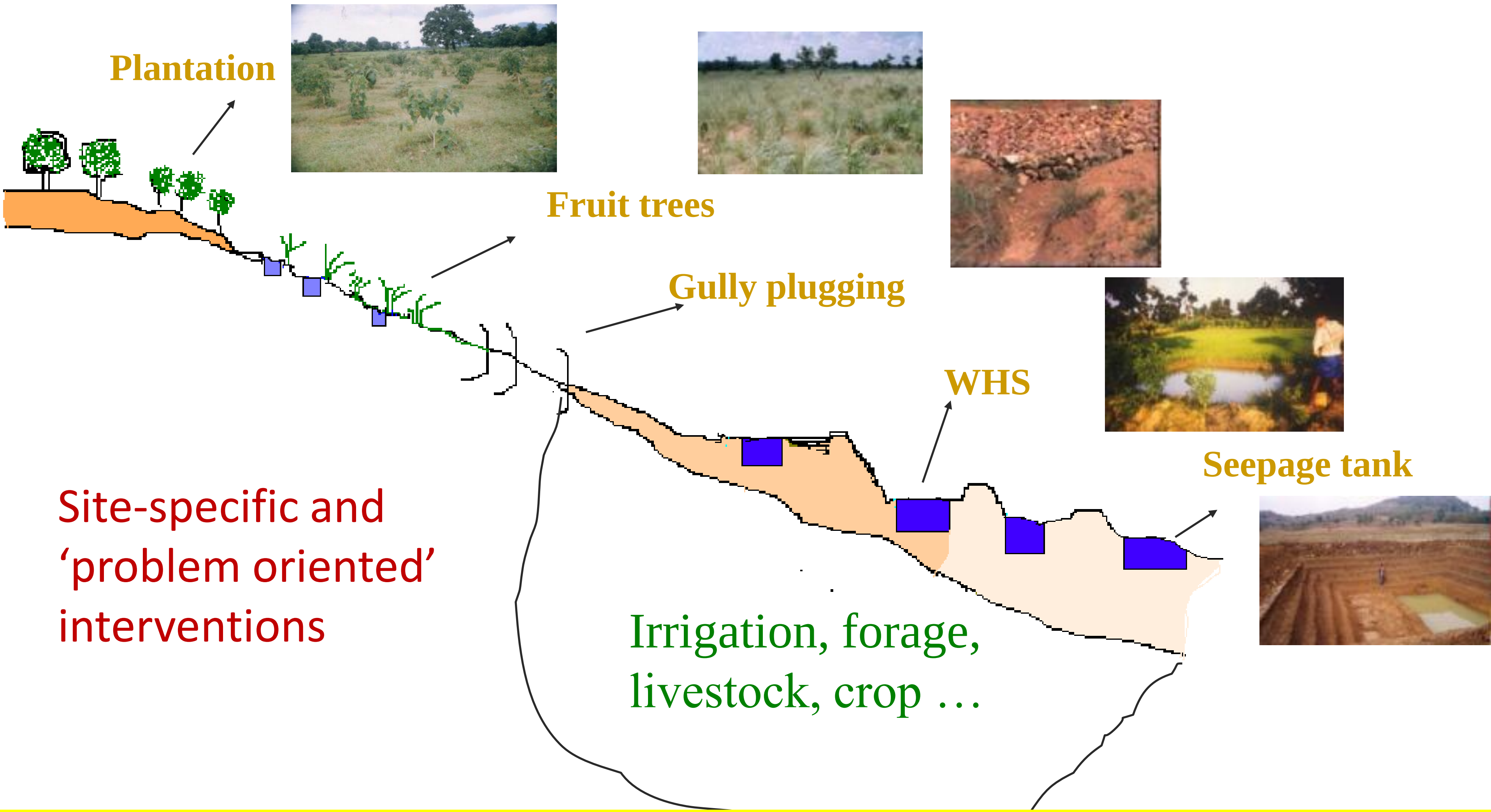
Technology choice and implementation

Technology choice – based on field visit, participatory mapping and data analysis

Linked and complementary technologies – site-specific



Technology choice …



Site-specific and 'problem oriented' interventions

Consider "the whole" as a system rather than individual "silos"

Implementation of options

- Based on prior agreement, implementation focused on AR watersheds

Implementation …

Adisgie Kebele (Geda watershed)
Total area = 1056 ha

Gudo Beret Kebele (Gina Beret watershed)
Total area = 682 ha

Activity	Kebele	Qty (m3)	Men	Women	Total	Cost estimate ETB/day
Gabion check dam	Adisge Gudo Beret	71 30	309 185	125 65	434 250	8246 4750
Wooded checkdam	Adisge Gudo Beret	730 120	243 99	50 16	293 115	5567 2185
Percolation pit	Adisge Gudo Beret	19 29	1440 974	80 318	1520 1292	28880 24548

Implementation …

The field exchange visit brought tremendous impact on those who visited and back in the village

Change in 'mindset' – able to realize the possibility of restoring degraded areas

Create awareness on the potential benefits of management options - huge gully/landslide can heal through reshaping and upslope conservation

Develop new water sources for drinking and irrigation: over 20 HHs in Jawe

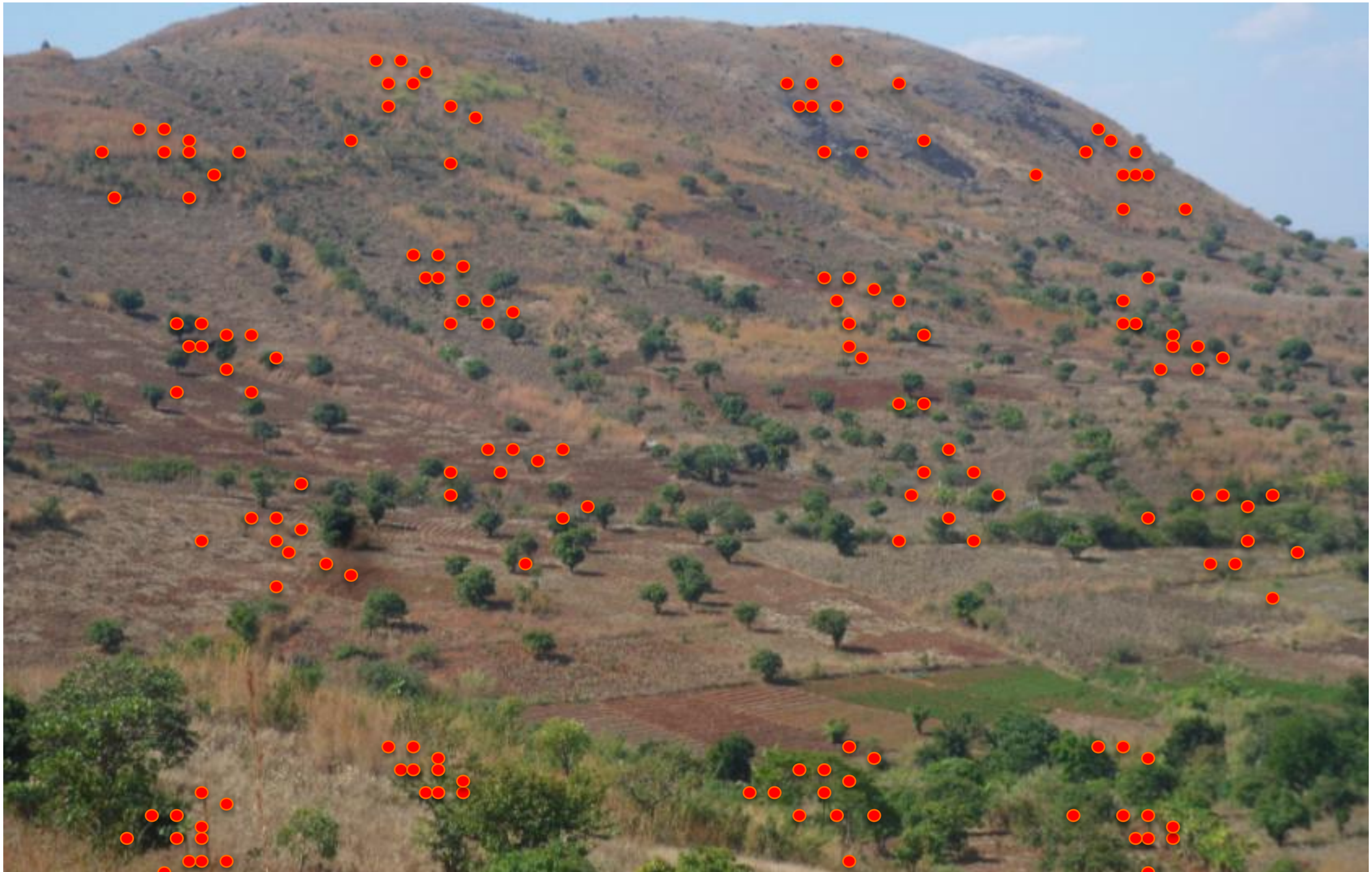
Data collection as part of the baseline, situation analysis, modelling and monitoring

Weather station

Infiltration measurement

Soil moisture measurement

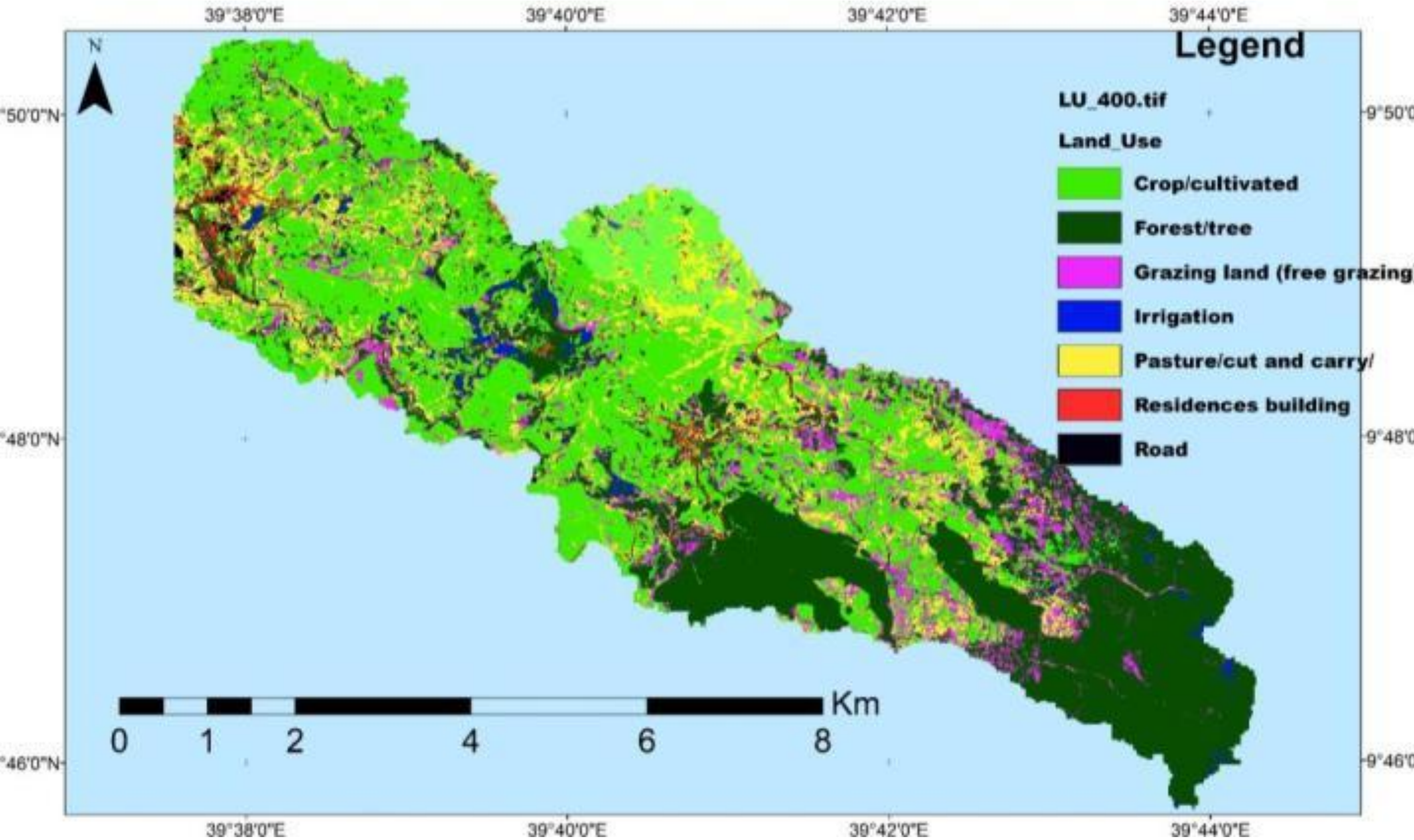
Soil and landscape attributes data collected based on spatially stratified sampling approach

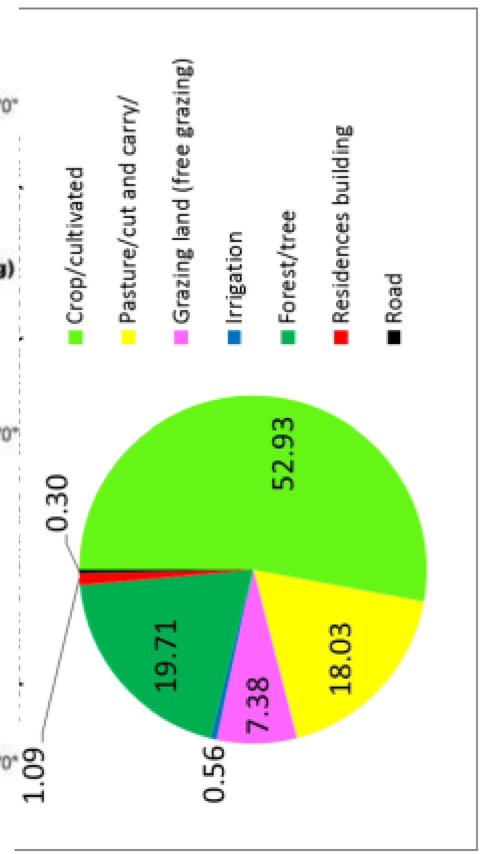


Socio-economic survey

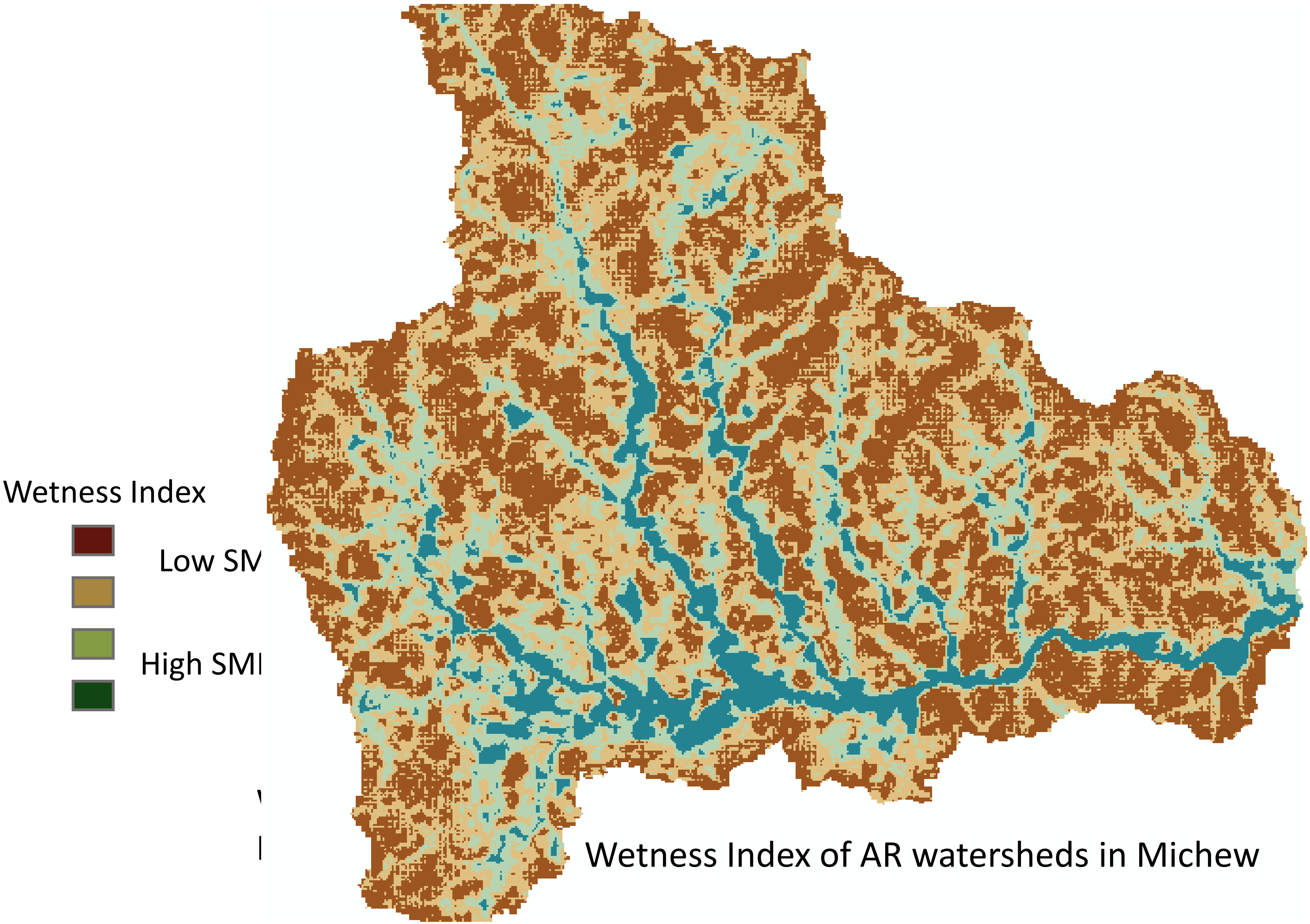
Data processing as part of the baseline, situation analysis, modelling and monitoring

Land use/cover of AR watersheds within Gudo Beret and Adisge Kebeles



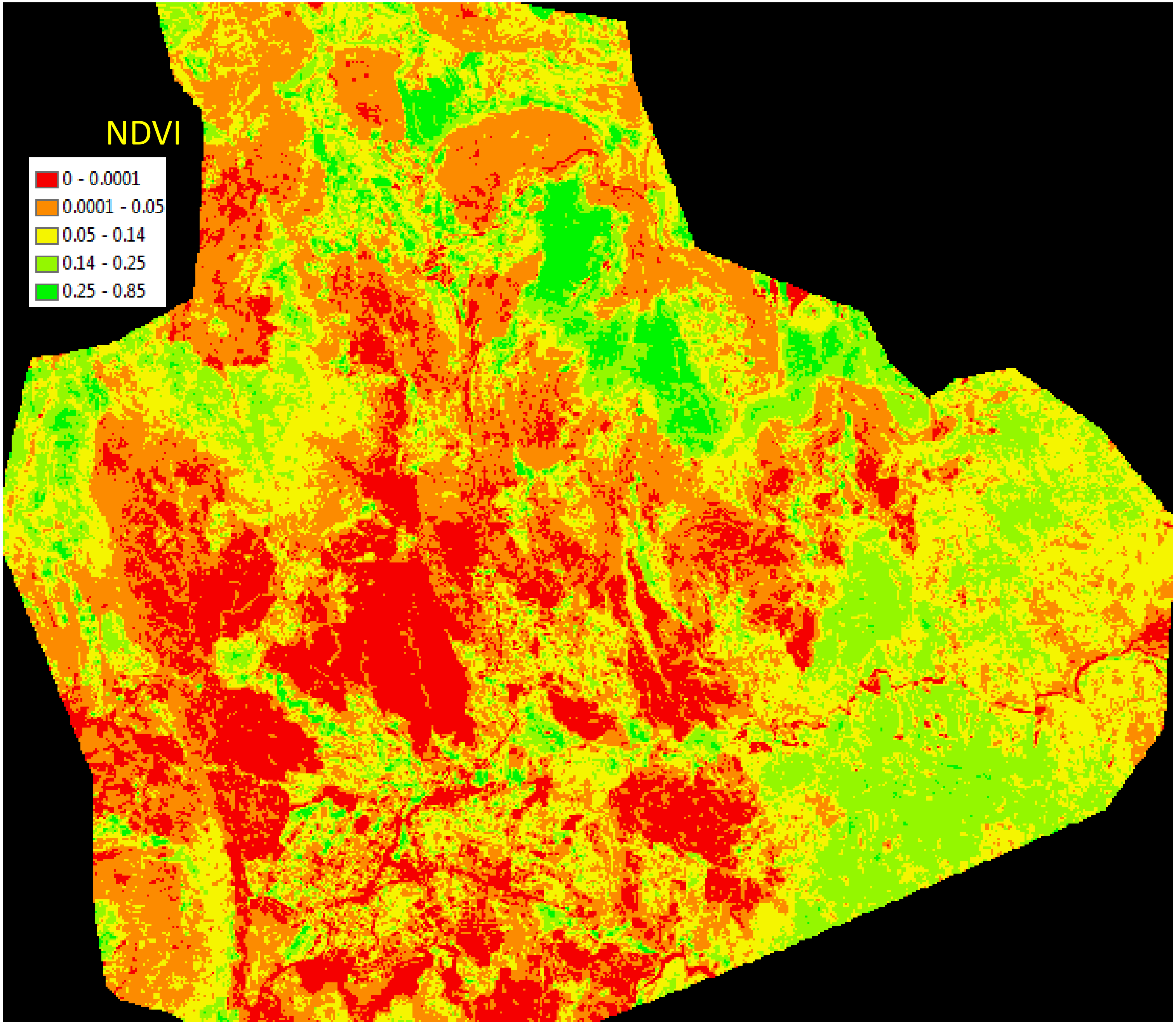


Data processing ….



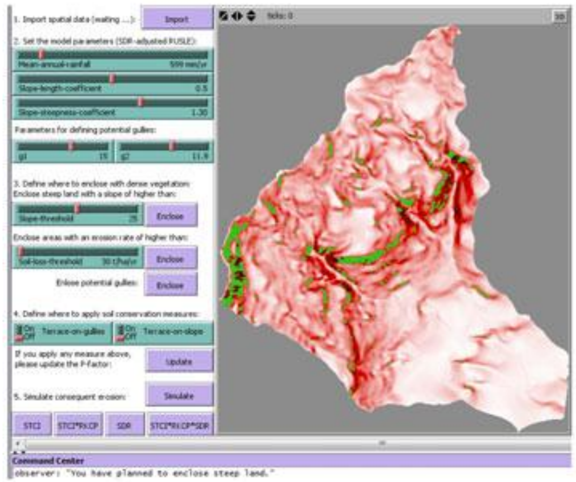
Wetness Index of AR watersheds in Michew

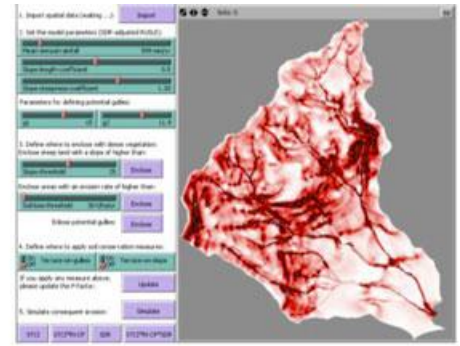
Vegetation cover and condition of AR watersheds in Michew

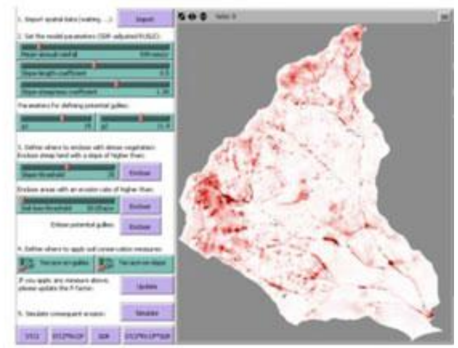


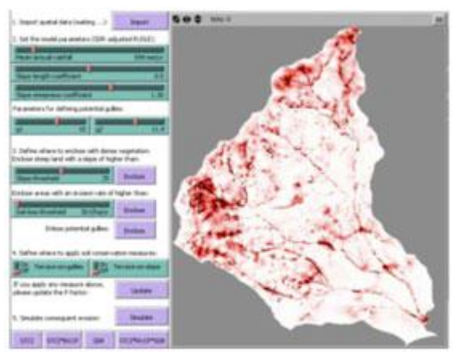
Integrated analysis: modelling, simulation

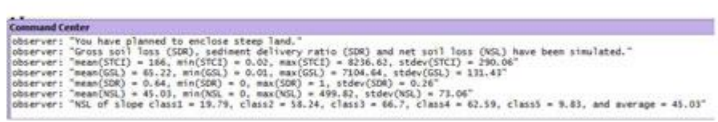
Develop landscape planning and management tools: simple (localized), InVEST, RIOS, SWAT

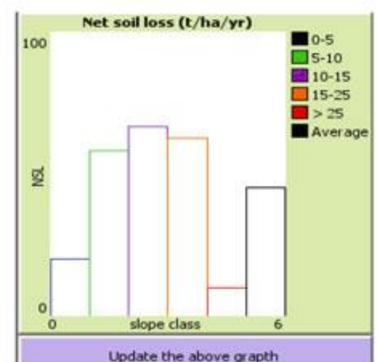












Monitoring: hydrological and erosion measurements

- To assess impact of interventions, there is a need to establish baseline condition
- Biophysical and socio-economic baseline data are being collected within Kebeles and watersheds
- Erosion plots (plot level) measurements and hydrological stations (landscape level) discharge and sediment loss estimates are key examples

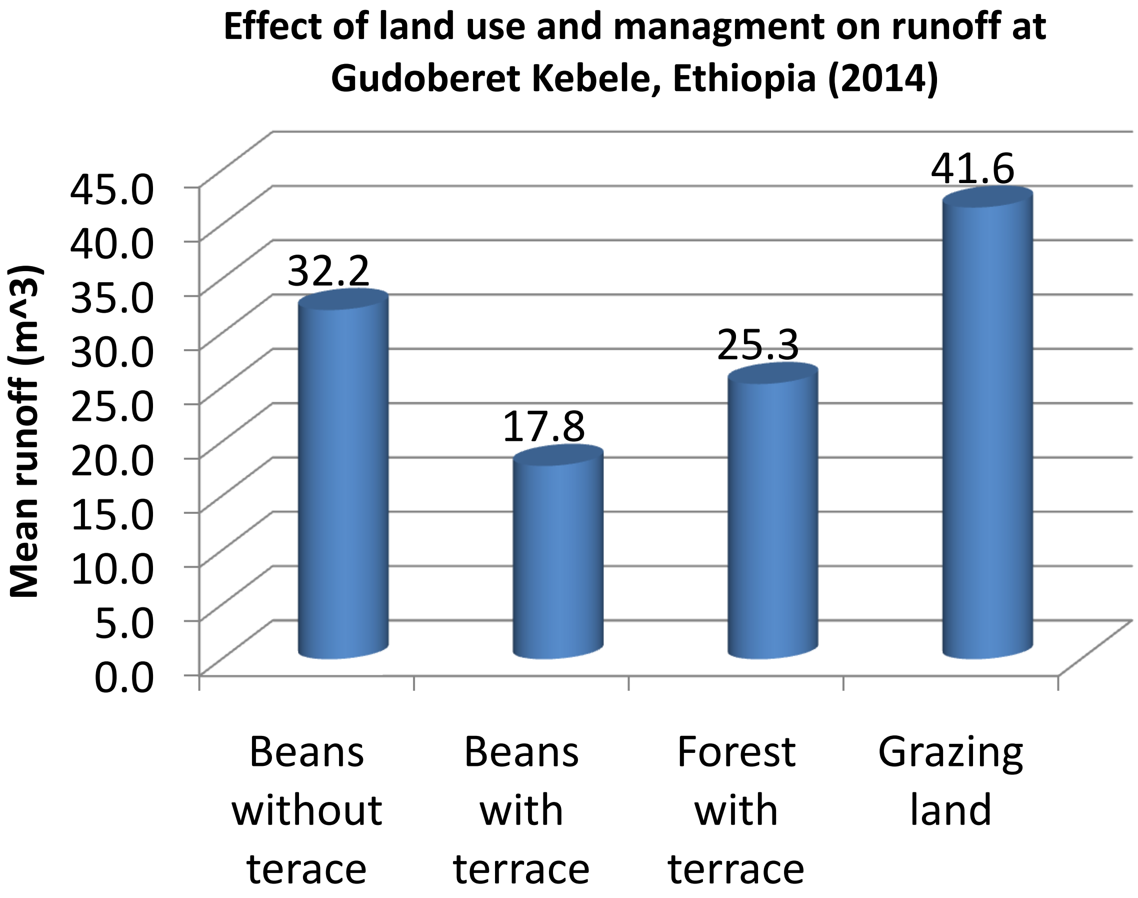
Plot level runoff and soil loss monitoring

- **Procedures**
  - Runoffs plots (22*4)
  - Slop divisor
  - Crop (faba bean) with and without SWC
  - Tree (Eucalptus) with SWC
  - Pasture (cut and carry)
  - Two replication
  - Daily measurement of runoff and sediment sample
  - Sediment concentration analysis in Debre Birhan research center

Plot level runoff and soil loss monitoring

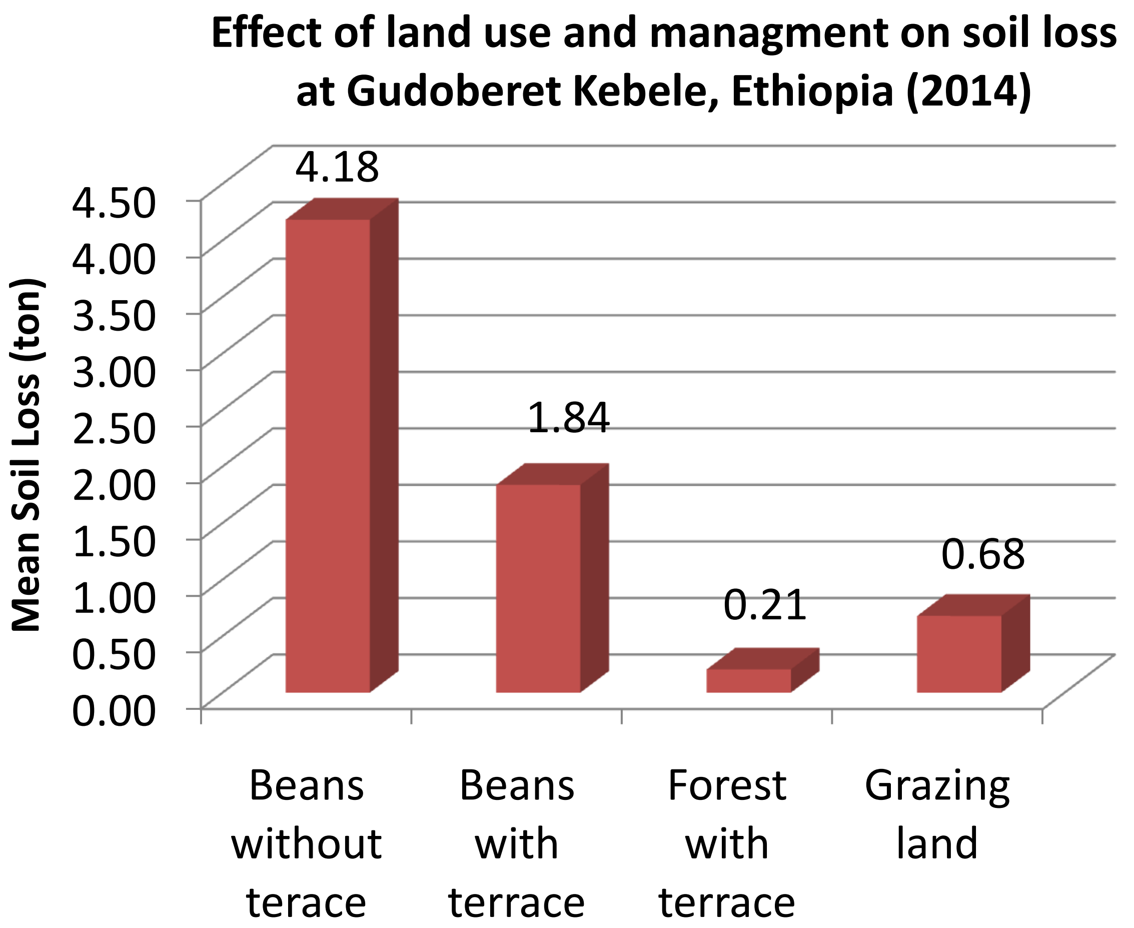
- Results

The highest runoff (41.6m^3) was observed on grazing land



Plot level runoff and soil loss monitoring

The terrace reduced the soil loss by more than half in comparison with untreated cultivation



Landscape discharge and sediment monitoring

- **Procedure ..**
  - Manual measurements of flow and sediment sampling were made at two hydrological stations.
  - Each measurement is consisted of
    - Manual reading of flow depth,
    - Determining instantaneous runoff discharge (Q, $m^3\ s^{-1}$) and
    - Sampling the suspended sediments.

Landscape discharge and sediment monitoring

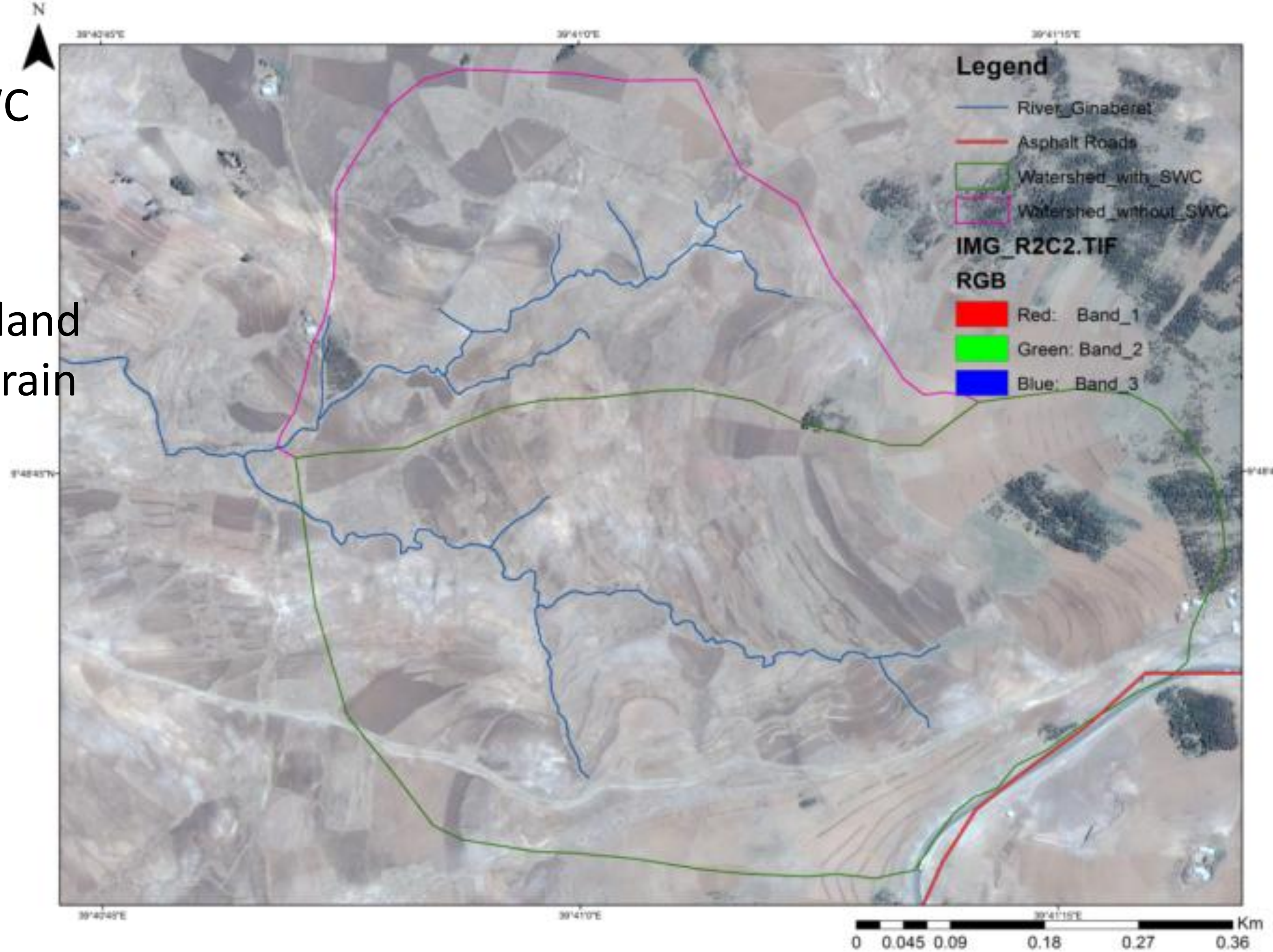
- **Procedure ….**
  - To convert the continuous flow depth to runoff discharge, depth–discharge relationships was developed between the manually measured instantaneous runoff discharges and their corresponding flow depths.
  - Sediment concentration was used to calculate the daily sediment yield corresponding to the observed Q.
  - Total sediment export was calculated as the sum of all the daily values.

Landscape discharge and sediment monitoring

- Study Watersheds:

- 25 ha without SWC
- 36 ha with SWC

- Generally similar land use/cover and terrain characteristics

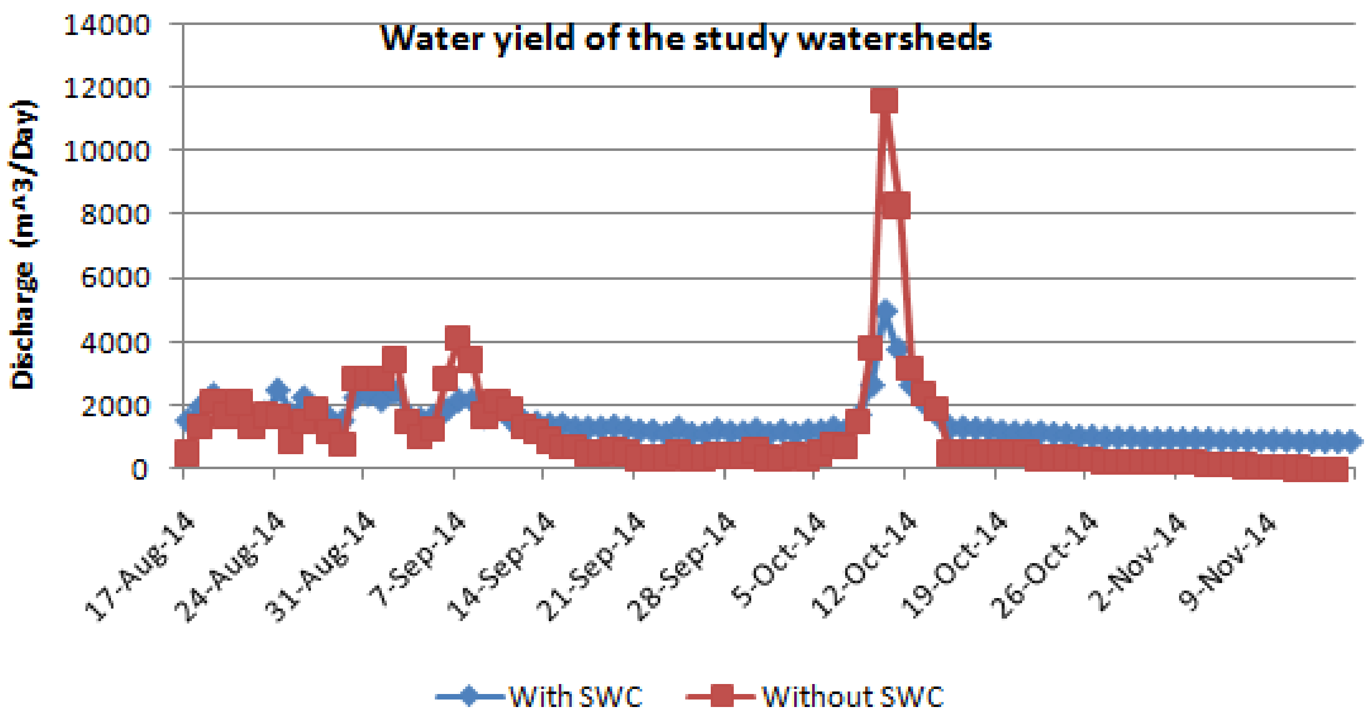


Landscape discharge and sediment monitoring

- **Results:** Water Yields

Parameters	Watersheds	
	With SWC	Without SWC
Area (Ha)	36.41	25.71
Q (m^3/watershed)	134682.4	105933
Discharge (Q) (m^3/ha)	3699.0	4120.3

- The water yields of un-conserved watershed is about 4120 m^3 per hectare
- Most of the discharge occurred during rainfall event in un-conserved WS

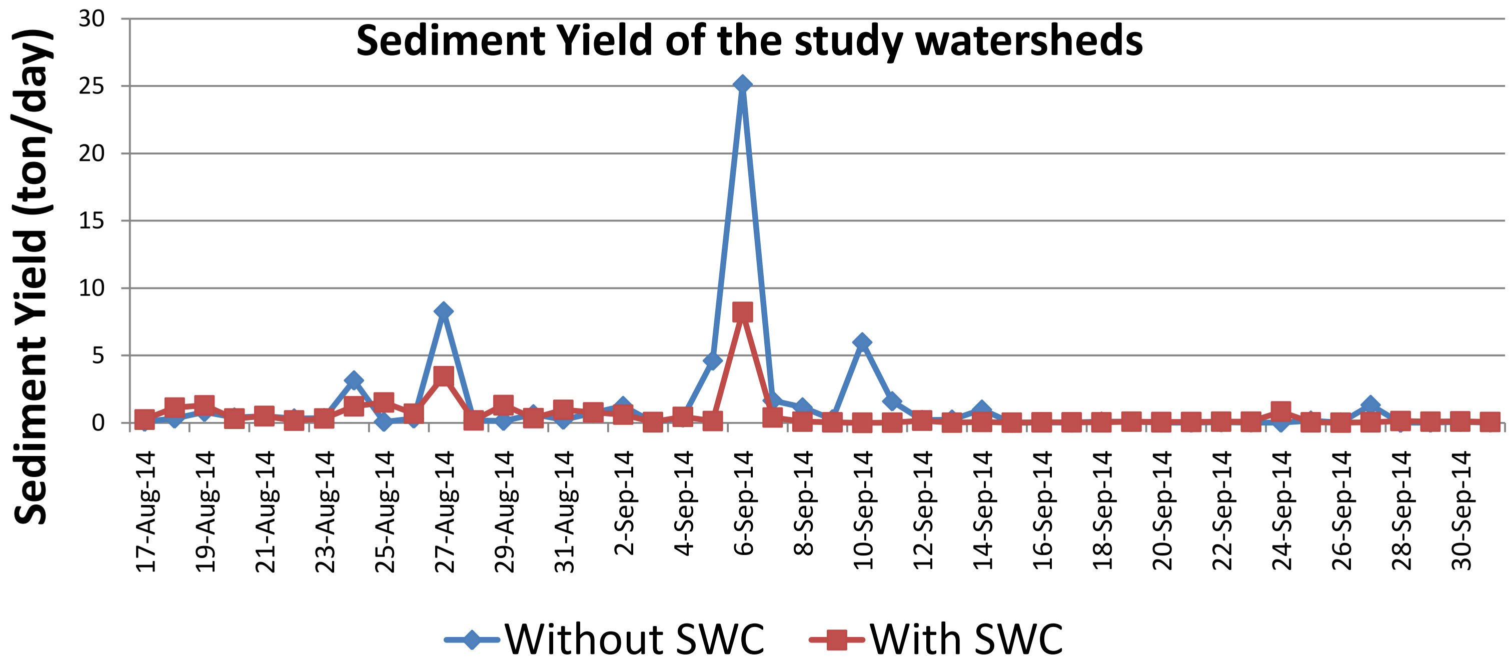


Landscape discharge and sediment monitoring

- **Results:** Sediment Yields

  The sediment yield of the un-conserved watershed is about more than two fold

Parameters	Watersheds	
	With SWC	Without SWC
Area (Ha)	36.41	25.71
Sediment Yield (ton/watershed)	26.44	61.84
Sediment Yield (ton/ha)	0.73	2.41



Landscape discharge and sediment monitoring

- The study showed that there is enough amount of water during rainy season and SWC practices significantly improve water retention capacity of the watershed.
- The water retention capacity of the watershed can be improved more if it is integrated with water harvesting practices.
- Irrigation potential-improve management
- Water loving crops, resistant crops to disease for cash crop
- The results of the experiment is used to calibrate the hydro-sedimentation and ecosystem modeling

Lessons Learned

- Action research
- Partnership (NGO, GOV…..)
- Capacity development is key
- Awareness
- Frequent monitoring
- Safely remove excess runoff out of the field and store it in water harvesting structure (such as check dams….) for groundwater recharge and subsequent use

7. What are our next plans?

- Continue partnership and collaborative implementation
- Demonstrate technologies – e.g., water harvesting, development
- SLM and SWC will enhance water availability and irrigation – improved management including crop choice necessary
- Options should be suited to specific environments and landscape conditions e.g., bunds with trenches maybe complemented with percolation ponds
- Incorporate useful trees, grasses, etc. on bunds to make interventions more attractive
- Monitoring and impact assessment

Acknowledgement

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Thank You very much!

Ameseginalehu !

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